

***Ceratophysella lobata* sp. n. from Siberia with notes on  
*C. brevisensillata* Yosii, 1961 (Collembola: Hypogastruridae)**

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***Ceratophysella lobata* sp. n. from Siberia with notes on *C. brevisensillata* Yosii, 1961 (Collembola: Hypogastruridae).** - *Ceratophysella lobata* sp. n. from Siberia (Russia) and Alaska (USA) is described. Notes on morphology and taxonomic status of the similar species *Ceratophysella brevisensillata* Yosii, 1961 are given.

**Keywords:** Collembola - Siberia - Alaska - taxonomy.

## INTRODUCTION

*Ceratophysella* Börner, 1932 is a large collembolan genus comprising 125 hemiedaphic species (Bellinger *et al.*, 2010). The genus is generally cosmopolitan, but the majority of species live in temperate climatic zone of Palaearctic (Babenko *et al.*, 1994, Thibaud *et al.*, 2004) and Nearctic (Christiansen & Bellinger, 1980). For long time *Ceratophysella brevisensillata* Yosii, 1961, described on material from the north-eastern part of the USA (Yosii, 1960, 1961), was one of the most easily distinguishable species of the genus mainly because of a notable difference in sensilla length on thoracic and abdominal terga. Based on specimens from Alaska, Fjellberg (1985) added new diagnostic features, namely a specific shape of one of the maxillary lamellae. However, in the eastern Palaearctic two distinct forms with short thoracic sensilla but different maxillae were detected (Babenko *et al.*, 1994) and it was not clear which one belongs to the true *C. brevisensillata*. Two different types of maxillae in the “species” were also found in Alaska (Arne Fjellberg, pers. comm.). Due to the kindness of Dr. Peter Schwendinger (Museum of Natural History Geneva) we were able to study several types of *C. brevisensillata* from Massachusetts, USA and to solve a problem of two east Palaearctic-Alaskan forms of this “species”. Below we redescribe types of *C. brevisensillata* and describe a new species having a different type of maxillae.

## MATERIAL AND METHODS

Terminology for the descriptions follows that given in Fjellberg (1984, 1999), Babenko *et al.* (1994) and Thibaud *et al.* (2004). Abbreviations used: ant. I-IV – antennal segments I-IV, th. I-III – thoracic terga I-III, abd. I-VI – abdominal terga I-VI. Depositories: MNHG – Museum of Natural History, Geneva, Switzerland; MPGU –

Chair of Zoology and Ecology of the Moscow State Pedagogical University, Russia; DBET – Department of Biodiversity and Evolutionary Taxonomy, Wrocław University, Poland; AF – collection of A. Fjellberg, Tjöme, Norway.

## RESULTS AND DISCUSSION

### *Ceratophysella brevisensillata* Yosii, 1961 Figs 1-9

MATERIAL EXAMINED: 10 paratypes (?) on slides, formerly in alcoholic vial labeled: „*Hypogastrura (Ceratophysella) pseudarmata* (Folsom) det. Yoshii, USA (Massachusetts), Arlington 15.XI.1950, leg. Bonet, on rain pools” (MNHG).

REDESCRIPTION: Body length 1-1.3 mm. Color in alcohol grey to dark grey. Eye patches black, anal spines light. Granulation fine and uniform, with 14-22 granules between setae  $p_1$  on abd. V. Dorsal chaetotaxy of B type, macrosetae  $p_2$  on th. II-III set nearly in line with setae  $p_1$ , setae  $m_3$  and  $m_4$  on th. II usually present, setae  $a_2$  longer than  $a_3$ , setae  $m_6$  absent, setae  $p_1$  and  $p_2$  on abd. IV macro- and microsetae respectively, setae  $p_3$  present (Figs 1-2). Arrangement of setae on head typical for the genus. Differentiation of dorsal setae into micro- and macrosetae distinct. Setae long, pointed, slightly curved and serrated (Fig. 3). Body sensilla (s)  $p_4$  on th. II-III and  $p_5$  on abd. I short, about 1/3-1/2 of microsetae. Body sensilla on abd. II-V and lateral parts of th. II-III long, but shorter than macrosetae (Fig. 3). Microsensilla (ms) on th. II present. Subcoxae I-III with 1, 2, 3 setae respectively.

Ant. IV with simple apical vesicle, subapical organite (or), microsensillum (ms), 7 cylindrical sensilla (2 lateral and 5 dorsal), about 15-20 short curved flattened at tips sensilla in ventral file (Fig. 4). Ant. III-organ with two long (lateral) and two short (internal) curved sensilla. Microsensillum on ant. III present. Eversible sac between ant. III-IV present. Ant. I with 7 setae.

Ocelli 8 + 8. Postantennal organ about twice as large as single ocellus, with four lobes of which the anterior pair larger than the posterior. Accessory boss present (Fig. 5).

Labrum with 5, 5, 4 setae and without apical papillae. 4 prelabrals present. Labium and head of maxilla (Fig. 6) of the *C. armata* type. Outer lobe with 2 sublobal hairs.

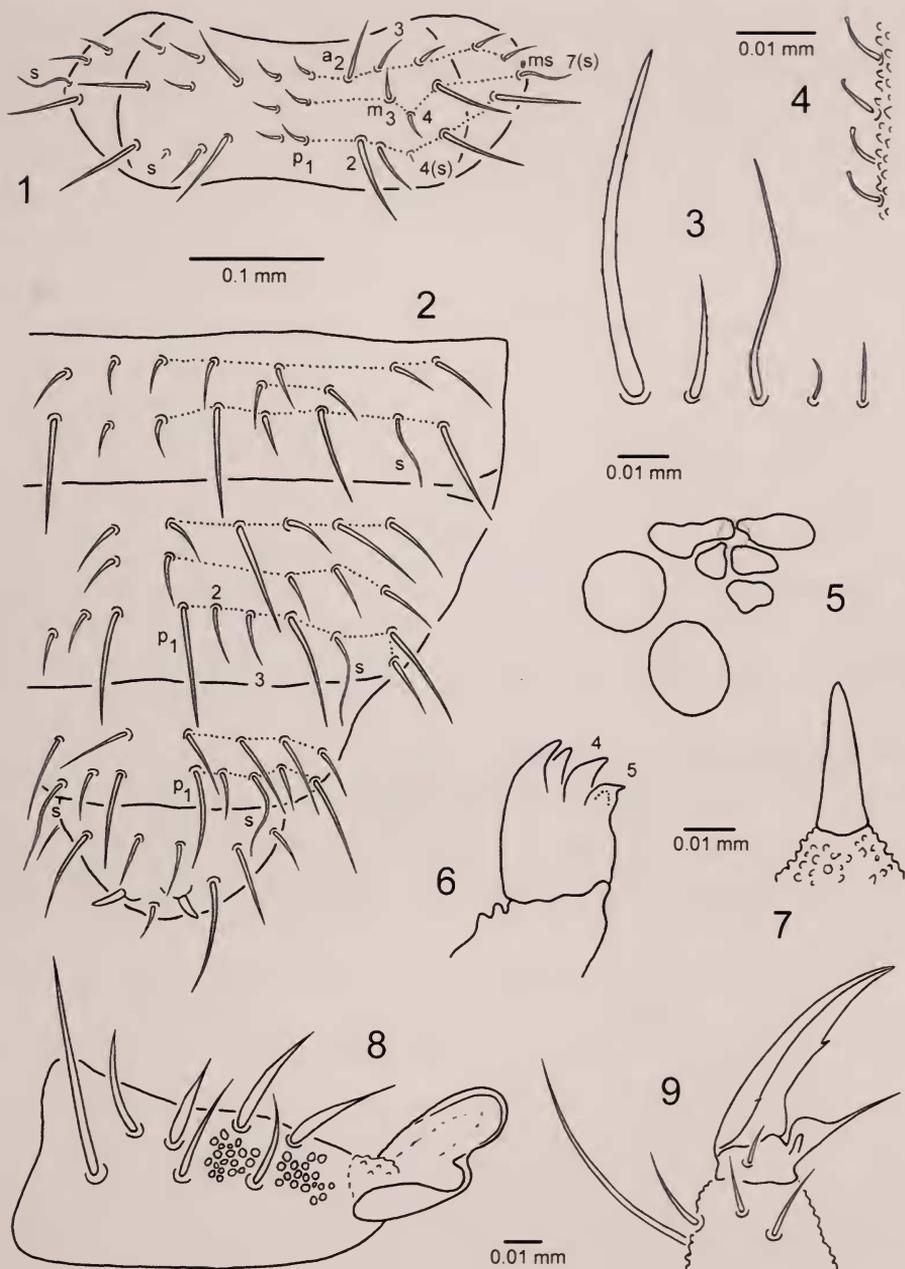
Tibiotarsi I, II, III with 19, 19, 18 setae respectively, tibiotarsal tenent hairs slightly longer than inner edge of claws and pointed. Claws with inner tooth and pair of indistinct lateral teeth. Empodial appendage with broad basal lamella and apical filament reaching inner tooth or slightly beyond (Fig. 9).

Ventral tube with 4 + 4 setae.

Furca well developed (Fig. 8). Dens/mucro ratio = ca. 2. Dens with 7 setae (2-4 inner modified). Mucro boat-like. Retinaculum with 4 + 4 teeth.

Anal spines short, half as long as inner edge of claws III, situated on basal papillae (Figs 2, 7).

REMARKS: The species was originally described from the north-eastern part of the USA. Later it was recorded from several localities within the same region (Christiansen & Bellinger, 1980), from Alaska and Chukotka (Fjellberg, 1985) and Siberia (Babenko *et al.*, 1994). Alaskan and East Palaearctic specimens treated as



FIGS 1-9

*Ceratophysella brevisensillata* Yosii, 1961. (1) Chaetotaxy of th. II. (2) Chaetotaxy of abd. III-VI. (3) From left to right: macroseta  $p_2$ , microseta  $p_1$ , sensilla  $m_7$ , sensilla  $p_4$  on th. II and sensilla  $p_5$  on abd. I. (4) Sensilla in ventral file on ant. IV. (5) Postantennal organ, accessory boss and neighbour ocelli. (6) Head of maxilla, lateral view. (7) Anal spine. (8) Dens and mucro. (9) Claw I with empodial appendage.

*C. brevisensillata* clearly differ from the above redescription of Yosii's types by having longer anal spines and coarser integument granulation. They could be considered as a separate species if their morphology was homogeneous within the area. Unfortunately it is not so and many important diagnostic characters vary in different parts of the distributional range without forming clear geographical pattern. Thus, inner margin of claw III/anal spine ratio varies in Palaearctic specimens from 1.8: 1 to 0.9: 1, being usually about 1: 1. Yosii's "a" measure is usually 10-12, but the whole range is 9-16. Chaetom differentiation into macro and microsetae is strong in most Palaearctic regions but specimens from Kemerovo Province and eastern Tuva are characterized by weak differences in seta length with  $a_2$  on th. II almost as long as  $a_1$  and  $a_3$ . Intermediary conditions have been also seen. The single available specimen from the Kyrgyz mountains has rather short but strong (almost spine-like) macrosetae. Alaskan and Chukotka specimens have 2 sublobals on maxillary outer lobe and  $p_3$  setae on abd. IV are usually absent. Populations from more western parts of Palaearctic differ by having only 1 sublobal hair and both  $p_2$  and  $p_3$  microsetae present on abd. IV. Nevertheless, two sublobals have been also seen in populations from Buryatia, eastern Tuva, north-eastern Altai and Kyrgyzstan and specimens without  $p_3$  on one or both sides on abd. IV can be found within many studied populations. Just now we prefer to treat all these forms as a single polymorphic species with a wide Siberian-American distributional range being sure that more work and material are needed to clear up their status. However the existing distributional gap (see Fig. 21) between east and west American populations raises some doubts that they are conspecific.

***Ceratophysella lobata* sp. n. Figs 10-20**

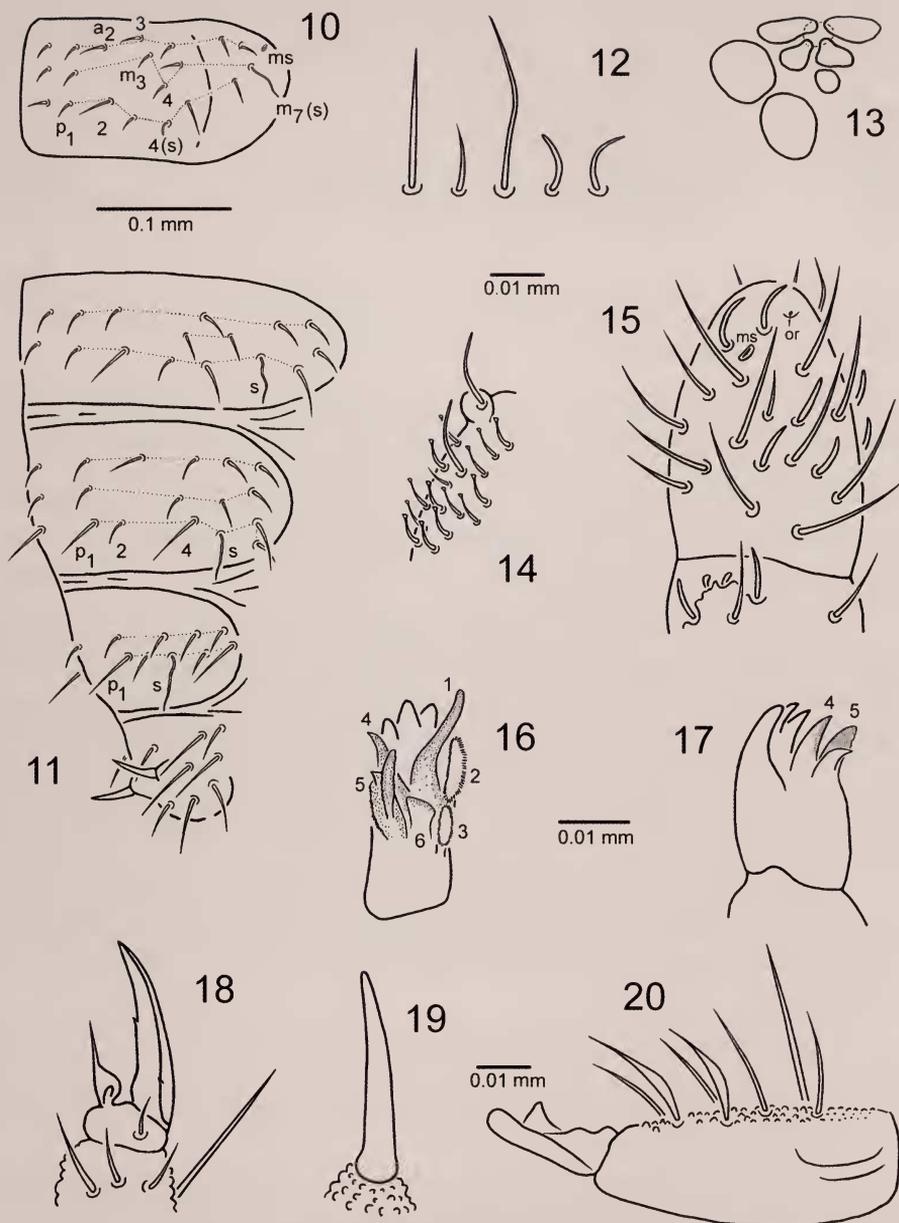
*Hypogastrura (Ceratophysella) brevisensillata*: Fjellberg (1985): 37

*Hypogastrura (Ceratophysella) cf. brevisensillata*: Babenko *et al.* (1994): 127

MATERIAL EXAMINED: Holotype, female, Russia, Jakutia (Sakha Republic), Suntar-Khayata Mt. Range, upper current of Kyumyume River (63° 13'N 139° 32'E), 1,800 m a.s.l., willow bushes with lichen cover, 9.VII.2002, leg. O. Makarova (MPGU). – Paratypes, 12 females, 11 males on slides and many specimens in alcohol, same data as holotype (MPGU, DBET and MNHG).

OTHER MATERIAL: Russia: 3 females, Ural Mts., Perm' Province, State nature reserve "Basegi", Srednii Baseg Mt. (58° 50'N 58° 40'E), alpine tundra, 23.VII.1990, leg. S. Esyunin (MPGU). – 2 females, same region but mixed forest with fern cover, 4.IX.1990, leg. S. Esyunin (MPGU). – 13 females and 3 males, Siberia, Putorana plateau, vicinity of Yt-Kyuel' lake (68° 08'N 91° 50'E), 700-900 m a.s.l., nival desert, 28.VII-13.VIII.1996, leg. A. Babenko (MPGU). – 7 females and 1 male, Siberia, Taimyr peninsula, upper current of Nizhnaya Agapa River (70° 06'N 87° 25'E), tundra, 6.VII-5.VIII.1999, leg. A. Babenko (MPGU). – 2 females and 1 male, Chukotka, vicinity of El'gygytgyn Lake (67° 26' 172° 10'E), tundra, 20.VIII.1974, leg. E. Bondarenko (MPGU). – 10 specimens, Chukotka, Aborigen, in fungi on dry ridge, 29.VII.1979, leg. A. Fjellberg (AF). – 9 specimens, USA, Alaska, Brook Range, W of Atigun Camp, dry alpine meadow, c. 1600 m a.s.l., 19.VIII.1976, leg. A. Fjellberg (AF). – 7 specimens, USA, Alaska, vicinity of Fairbanks, litter in aspen forest, 21.VII.1980, leg. A. Fjellberg (AF).

DESCRIPTION: Body length 1-1.2 mm. Color in alcohol light to dark grey-brown. Eye patches black, anal spines light. Granulation fine and uniform, usually 12-15 granules between setae  $p_1$  on abd. V. Dorsal chaetotaxy of B type, macrosetae  $p_2$  on th. II-III set nearly in line with setae  $p_1$ , setae  $m_3$  and  $m_4$  on th. II usually present, setae  $a_2$  slightly longer than  $a_3$ , setae  $m_6$  absent, setae  $p_1$  and  $p_2$  on abd. IV macro- and micro-



FIGS 10-20

*Ceratophysella lobata* sp. n. (10) Chaetotaxy of th. II. (11) Chaetotaxy of abd. III-VI. (12) From left to right: macroseta  $p_2$ , microseta  $p_1$ , sensilla  $m_7$ , sensilla  $p_4$  on th. II and sensilla  $p_5$  on abd. I. (13) Postantennal organ, accessory boss and neighbour ocelli. (14) Sensilla in ventral file on ant. IV. (15), Chaetotaxy of ant. III-IV. (16) Head of maxilla. (17) Head of maxilla, lateral view. (18) Claw III with empodial appendage. (19) Anal spine. (20) Dens and mucro.



FIG. 21

Known distribution of *C. lobata* sp.n. (white dots) and *C. brevisensillata* Yosii, 1961 (black dots, American data according to Christiansen & Bellinger (1980)). Black & white dots in Alaska and Chukotka indicate uncertain records (data from Fjellberg (1985)).

setae respectively, setae  $p_3$  absent (Figs 10-11). Arrangement of setae on head typical for the genus. Differentiation of dorsal setae into micro- and macrosetae not strong and more pronounced on last abdominal terga. Setae short, fine, pointed, slightly curved and serrated. Body sensilla  $p_4$  on th. II-III and  $p_5$  on abd. I usually equal to microsetae; thick and sometimes curved. Body sensilla (s) on abd. II-V and lateral parts of th. II-III about as long as macrosetae (Fig 12). Microsensilla (ms) on th. II present. Subcoxae I-III with 1, 2, 3 setae respectively.

Ant. IV with simple apical vesicle, subapical organite (or), microsensillum (ms), 5-7 (usually 7) cylindrical sensilla (2 lateral and 3-5 dorsal) (Fig. 15) and about 15 short curved flattened at tips sensilla in ventral file (Fig. 14). Ant. III-organ with two long (lateral) and two short (internal) curved sensilla (Fig. 15). Microsensillum on ant. III present. Eversible sac between ant. III-IV present. Ant. I with 7 setae.

Ocelli 8 + 8. Postantennal organ about twice as large as single ocellus, with four lobes of which the anterior pair larger than the posterior. Accessory boss present (Fig. 13).

Labrum with 5, 5, 4 setae and without apical papillae. 4 prelabrals present. Labium of the *C. armata* type. Maxillary head with prolonged denticulate lobe on lamella 5 which only slightly shorter than lamella 4 (Figs 16-17). Outer lobe with 2 sublobal hairs.

Tibiotarsi I, II, III with 19, 19, 18 setae respectively, tibiotarsal tenent hairs nearly as long as inner edge of claws and usually pointed, sometimes truncate. Claws with inner tooth and pair of indistinct lateral teeth. Empodial appendage with broad basal lamella and apical filament reaching inner tooth or slightly beyond (Fig. 18).

Ventral tube with 4 + 4 setae.

Furca well developed. Dens/mucro ratio = ca. 2. Dens with 7 setae (2 inner modified). Mucro boat-like (Fig. 20). Retinaculum with 4 + 4 teeth.

Anal spines equal to or slightly longer than inner edge of claws III, situated on basal papillae (Figs 11, 19).

VARIABILITY: Siberian and available Alaskan material appears to be morphologically homogeneous throughout the distributional range. However Fjellberg (1985) mentioned that in Alaska "exact chaetotaxy and differentiation in macro/microchaetae is rather variable" and alpine specimens from Brook Range "frequently have long,

hair-like  $p_5$  sensilla on Abd.I". It may indicate the presence of the third separate form there apart from *C. lobata* sp. n. and *C. brevisensillata* s. l.

ETYMOLOGY: The name reflects the most characteristic feature of the new species - the presence of an additional lobe on one of the maxillary lamellae.

DISTRIBUTION: The new species which seems to be a usual inhabitant of Subarctic Mountains was found in few remote Palaeartic regions from Ural to Chukotka and in Alaska (see map on Fig. 21 and material above).

AFFINITIES: A combination of four features, viz. a full number of ocelli, a chaetotaxy of B type, shortened dorsal sensilla on three first terga and maxillae with prolonged lobe on lamella 5, distinguishes *C. lobata* sp. n. from all other known species of the ceratophysellan lineage. Thus, only *C. brevisensillata* and *Boneto-gastrura nivalis* (Martynova) are characterized by the same type of sensillar differentiation, but both have the usual armata-type of maxillae and longer dorsal setae which are more clearly differentiated into macro/microsetae. Apart from this, *B. nivalis* has only 4 + 4 ocelli and partly reduced chaetotaxy ( $m_3$  always and  $m_4$  usually absent on th. II-III, abd. I-III without m-setae as a rule and  $p_3$  often absent on abd. I-IV).

Shortened dorsal sensilla on thorax similar to those in *C. lobata* sp. n. are also characteristic of *C. bengtssoni* (Ågren), *C. microchaeta* (Babenko) and *B. variabilis* (Christiansen) but maxillae of all these species are modified differently with broadened lamella 1 and without prolonged lobe on lamella 5.

The same type of maxillae as in *C. lobata* sp. n. is known only for *C. sigillata* (Uzel), *C. sibirica* Martynova and *C. pseudarmata* (Folsom)<sup>1</sup>. They can be easily distinguished from *C. lobata* sp. n. due to long dorsal sensilla on all terga and clearly clavate tibiotarsal tenent hairs (pointed or truncate in *C. lobata* sp. n.).

The new species runs in the most recent key to the Palaeartic *Ceratophysella* species (Thibaud *et al.*, 2004) to couplet 11 which needs to be modified as follows:

- 11    Sensillum  $p_5$  on abd. I small, spine-like; micro- and macrosetae clearly differentiated . . . . . 11\*
- Sensillum  $p_5$  on abd. I long, hair like; micro- and macrosetae weakly . . . . . differentiated . . . . . *microchaeta* (Babenko, 1994)
- 11\*    Maxillary head of the armata type without prolonged lobe on lamella 5 . . . . . *brevisensillata* Yosii, 1961
- Maxillary head with prolonged denticulate lobe on lamella 5 (Figs 16-17) . . . . . *lobata* sp. n.

#### ACKNOWLEDGEMENTS

We would like to express our sincere thanks to Peter Schwendinger (Museum of Natural History Geneva) and Arne Fjellberg (Tjømø, Norway) for the loan of the material.

<sup>1</sup> According to Babenko *et al.* (1994) a specific status of these three species needs further confirmation.

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